

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

SRM Number: 3131a
MSDS Number: 3131a
SRM Name: Magnesium Standard Solution

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MSDS Coordinator: Mario J. Cellarosi
Telephone: 301-975-6776
FAX: 301-926-4751
E-mail: SRMMSDS@nist.gov

Emergency Telephone ChemTrec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)

Description: This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of magnesium. One unit of SRM 3131a consists of 50 mL of a single element solution in a high density polyethylene bottle sealed in an aluminized bag. The solution is prepared gravimetrically to contain a known mass fraction of magnesium. The solution contains nitric acid at a volume fraction of approximately 10 %.

Material Name: Magnesium Standard Solution

Other Designations:

Magnesium: Mg; magnesium metal.

Magnesium Nitrate: Nitric acid, magnesium salt; magnesium (II) nitrate.

Nitric Acid: Aqua fortis; hydronitrate; azotic acid; engraver's acid.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Concentration (%)
Nitric Acid	7697-37-2	231-714-2	10
Magnesium Nitrate	10377-60-3	233-826-7	6.1
Magnesium	7439-95-4	231-104-6	1.0

EC Classification, R/S Phrases: Refer to Section 15, Regulatory Information.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 4 Fire = 0 Reactivity = 2

Major Health Hazards: Nitric acid can cause severe or fatal burns if inhaled, swallowed, or absorbed through the skin. Magnesium and magnesium nitrate can cause irritation by the same routes; a large ingested dose of magnesium can cause severe illness with possible damage to the heart and other organs. Nitrates can cause blood abnormalities and possible kidney damage.

Physical Hazards: May react on contact with water.

Potential Health Effects

Inhalation:	Nitric acid, if inhaled, can damage the mucous membranes and respiratory tract, causing spasm, inflammation of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Magnesium and magnesium nitrate can irritate the upper respiratory tract. Inhalation of magnesium fumes can cause flu-like symptoms (metal fume fever), but the response is usually milder than with some other metals, such as zinc. Chronic exposure to magnesium dust may be associated with ulcers of the stomach and duodenum.
Skin Contact:	Nitric acid can cause severe skin burns. Effects of acid burns may be delayed. Contact with magnesium or magnesium nitrate may cause skin irritation with redness and pain.
Eye Contact:	Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Contact with magnesium or magnesium nitrate may cause eye irritation with redness and pain.
Ingestion:	Nitric acid can cause severe burns and damage to the GI tract. Ingestion of a large dose of magnesium can cause nausea, vomiting, diarrhea, irregular heartbeat, and coma; damage to the heart and GI tract may occur. Effects of ingested magnesium vary depending on absorption, but a dose as small as 30 g may be fatal. Like other nitrates, magnesium nitrate can also cause methemoglobinemia (an abnormal condition of the blood), with cyanosis, convulsions, and breathing difficulty.

Medical Conditions Aggravated by Exposure: The mixture and its three components may aggravate pre-existing disorders of the eyes, skin, GI tract, kidneys, and respiratory tract. Persons with intestinal or kidney disorders may be more susceptible than others to the toxic effects of magnesium salts.

Listed as a Carcinogen/ Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

4. FIRST AID MEASURES

Inhalation: Move the person to fresh air immediately. If not breathing, qualified medical personnel may start CPR or give oxygen if necessary. Get medical aid at once, and bring the container or label.

Skin Contact: Remove contaminated clothing and shoes. Flush affected skin with water for at least 15 minutes, then wash thoroughly with soap and water. If burns are severe or if skin irritation persists, get medical aid and bring the container or label. Wash contaminated clothing before reusing.

Eye Contact: Remove contact lenses (if any). Do not allow victim to rub eyes or keep eyes closed. Flush eyes with large amounts of running water for at least 30 minutes, keeping eyelids open and raising lids to remove all chemical. Get medical aid at once, and bring the container or label.

Ingestion: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Get medical aid at once, and bring the container or label.

Note to Physician (Nitric Acid): Wash affected skin with 5% solution of sodium bicarbonate (NaHCO₂). Activated charcoal is of no value. Do not give bicarbonate to neutralize the material.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: No data are available for this mixture, but it is not believed to be a significant fire or explosion hazard. The behavior of the solution may differ from that of the individual components. Nitric acid does not burn, but it is a powerful oxidizing agent that can react with combustible materials to cause fires. Magnesium nitrate is also a strong oxidizer that may ignite on contact with combustible materials.

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire: water spray, dry chemical, carbon dioxide, or foam. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen. (These guidelines apply to the mixture; when the components are considered separately, different precautions may apply.)

Fire Fighting: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point (°C): N/A

Autoignition (°C): N/A

Lower Explosive Limit (LEL): N/A

Upper Explosive Limit (UEL): N/A

Flammability Class (OSHA): N/A

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Notify safety personnel of spills. Surfaces contaminated with this material should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Disposal: Refer to Section 13, Disposal Considerations.

7. HANDLING AND STORAGE

Storage: Store unopened containers of this material in a dry place at room temperature. Protect from physical damage, heat, and light, and isolate from incompatible materials. Use opened containers immediately or discard.

Safe Handling Precautions: Wear gloves and chemical safety goggles (Section 8). Engineering controls should maintain airborne concentrations below TLV (Section 8).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Nitric Acid:

ACGIH TLV-TWA: 5 mg/m³

OSHA TLV-TWA: 5 mg/m³

Magnesium Nitrate (for identified solution)

ACGIH TLV-TWA: None established.

OSHA TLV-TWA: None established.

Magnesium (for identified solution)

ACGIH TLV-TWA: None established.

OSHA TLV-TWA: None established.

Ventilation: Use local or general exhaust to keep employee exposures below limits. Local exhaust ventilation is preferred because it can control contaminant emissions at the source, preventing dispersion into the general work area. Refer to the ACGIH document *Industrial Ventilation, a Manual of Recommended Practices*.

Respirator: If necessary, refer to the NIOSH document *Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84* for selection and use of respirators certified by NIOSH.

Eye Protection: Use chemical safety goggles where dusting or splashing of solutions may occur. See OSHA standard (29 CFR 1910.133) or European Standard EN166. The employer should provide an emergency eye wash fountain and safety shower in the immediate work area.

Personal Protection: Wear appropriate gloves and protective clothing to prevent contact with skin.

9. PHYSICAL AND CHEMICAL PROPERTIES

Nitric Acid	Magnesium Nitrate	Magnesium
Appearance and Odor: Colorless to slightly yellow liquid, darkens to brown upon aging and exposure to light; irritating, pungent odor.	Appearance and Odor: Hygroscopic solid	Appearance and Odor: Silvery white metal, odorless
Relative Molecular Weight: 63.02	Relative Molecular Weight: 148.3	Relative Molecular Weight: 24.3
Molecular Formula: HNO ₃	Molecular Formula: Mg(NO ₃) ₂	Molecular Formula: Mg
Specific Gravity: 1.05 (10%)	Specific Gravity: 1.46	Specific Gravity: 1.7 @ 5 °C
Solvent Solubility: Decomposes in alcohol	Solvent Solubility: Soluble in alcohol and liquid ammonia; slightly soluble in concentrated nitric acid	Solvent Solubility: Soluble in mineral acids and concentrated hydrogen fluoride; insoluble in alkali
Water Solubility: Soluble	Water Solubility: Soluble (125 g in 100 mL)	Water Solubility: Reacts with water
Boiling Point: 86 °C	Boiling Point: 330 °C; decomposes	Boiling Point: 1090 °C
Vapor Density (Air=1): 2.17	Vapor Density (Air=1): N/A	Vapor Density (Air=1): N/A
pH: 1.0 (0.1M solution)	pH: N/A	pH: N/A

NOTE: The physical and chemical data provided are for the pure components. No physical or chemical data are available for this solution of magnesium and nitric acid. The actual behavior of the solution may differ from the individual components.

10. STABILITY AND REACTIVITY

Stability: X Stable Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Contact with moisture, heat, combustible materials, or incompatible materials; dust generation.

Incompatible Materials:

Nitric Acid: Incompatible with numerous materials including organic materials, plastics, rubber, chlorine, and metal ferrocyanide.

Magnesium Nitrate: Incompatible with combustible materials, reducing agents, acids, metal salts, and dimethyl formamide.

Magnesium: Incompatible with combustible materials, acids, metals, oxidizing agents, metal salts, halocarbons, cyanides, halogens, peroxides, and metal oxides.

Fire/Explosion Information: See Section 5.

Hazardous Decomposition: Thermal decomposition of this mixture can produce nitrogen oxides (NO, NO₂, N₂O), hydrogen compounds, magnesium oxide (MgO), and other toxic or irritating gases.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: X Inhalation X Skin X Ingestion

Nitric Acid:

Human, oral: LD_{Lo} = 430 mg/kg

Rat, oral: LD₅₀ > 90 mg/kg

Rat, inhalation: LC₅₀ (4 hrs) = 130 mg/m³

Magnesium Nitrate:

Rabbit, skin: 500 mg/24 hrs (mild skin irritation)

Rabbit, eye: 500 mg/24 hrs (mild eye irritation)

Rat, oral: LD₅₀ = 5440 mg/kg

Magnesium:

Dog, oral: LD_{Lo} = 230–280 mg/kg

Target Organ(s): Respiratory tract, eyes, skin, GI tract, kidneys, heart, blood.

Mutagen/Teratogen: Nitric acid has caused birth defects in animals under experimental conditions, and has also been investigated as a possible mutagen. Elemental magnesium and magnesium nitrate are not classified as reproductive hazards.

12. ECOLOGICAL INFORMATION

Nitric Acid, Ecotoxicity Data:

Green shore crab (*Carcinus maenas*): LC₅₀ (48 hrs) = 180,000 µg/L

Starfish (*Asterias rubens*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L

Hooknose (*Agonus cataphractus*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L

Brook trout (*Salvelinus fontinalis*): NR-LETH = 1,562 µg/L

Cockle (*Cerastoderma edule*): LC₅₀ (48 hrs) = 330,000 to 1,000,000 µg/L

Magnesium Nitrate, Ecotoxicity Data:

Snail (*Bulinus globosus*): Mortality (96 hrs, endpoint not reported) = 240,000 µg/L

Water flea (*Daphnia magna*): Mortality (endpoint not reported) = 32,000 µg/L

Magnesium:

No ecotoxicity data were found for elemental magnesium.

Environmental Summary: One or more components of this mixture may be toxic to some aquatic organisms. Large spills should not be released to the environment.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: One or more components of this mixture is a RCRA hazardous waste. Dispose of container and unused contents in accordance with federal, state, and local requirements for acid waste, which vary according to location. Decontaminate containers before recycling. Processing, use, or contamination of this product may change the waste management options.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA:

Nitric Acid Solution: Hazard Class 8, UN2031, Packing Group II, Packing Instruction 807.

15. REGULATORY INFORMATION

U.S. REGULATIONS

CERCLA Sections 102a/103 (40 CFR 302.4):

Nitric Acid: RQ = 1000 lb.

Magnesium and Magnesium Nitrate: Not regulated

SARA Title III Section 302: Nitric acid is regulated

SARA Title III Section 304: Nitric acid is regulated

SARA Title III Section 313: Nitric acid is regulated; $\text{Mg}(\text{NO}_3)_2$ is regulated as N511, Nitrate Compounds.

OSHA Process Safety (29 CFR 1910.119): Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE: Yes

CHRONIC: Yes

FIRE: No

REACTIVE: Yes

SUDDEN RELEASE: No

STATE REGULATIONS

California Proposition 65: None of the components are regulated.

CANADIAN REGULATIONS

WHMIS Classification: Not determined

EUROPEAN REGULATIONS

EU/EC Classification:

Nitric Acid: O (Oxidizer), C (Corrosive)

Magnesium Nitrate: O (Oxidizer); not classified in Annex I of Directive 67/548/EEC; not on a priority list.

Magnesium: F (Flammable)

Risk Phrases (mixture):

R23 (toxic by inhalation)
R25 (toxic if swallowed)
R35 (causes severe burns)
R36/37/38 (irritating to eyes, respiratory system and skin)

Safety Phrases (mixture):

S20/21 (when using, do not eat, drink or smoke)
S28 (wash after contact with skin)
S45 (in case of accident or illness, see doctor; show label)
S60 (dispose of this material and its container as hazardous waste)

NATIONAL INVENTORY STATUS

U.S. Inventory (TSCA): All components are listed.

TSCA 12(b), Export Notification: No components are listed.

16. OTHER INFORMATION

Sources:

IUCLID Chemical Data Sheet: Magnesium. European Chemicals Bureau, 19 February 2000.

IUCLID Chemical Data Sheet: Magnesium Nitrate. European Chemicals Bureau, 19 February 2000.

PAN Pesticide Database: Nitric Acid.

PAN Pesticide Database: Magnesium Nitrate.

U.S. National Institute for Occupational Safety and Health, *NIOSH Pocket Guide to Chemical Hazards*, June 1990 edition. DHHS (NIOSH) Publication No. 90-117.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.